VIRGINIA DEPARTMENT OF TRANSPORTATION

TRAFFIC ENGINEERING DIVISION

INSTRUCTIONAL & INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: Pavement Markings	**NUMBER:** IIM-TE-395
	SUPERSEDES:
SPECIFIC SUBJECT: Temporary Pavement Marking Width and Materials	**DATE:** February 17, 2021
APPROVAL: /original signed by/ Raymond J. Khoury, P.E. State Traffic Engineer Richmond, VA 02/09/2021	

EXECUTIVE SUMMARY[1]

- Audience: Primarily intended for designers who develop MOT plans, and District personnel considering changes to the temporary marking widths or materials during construction.
- Impact: This IIM applies to all work zones, though most significant impact is to design-bid-build and D-B/P3 contracts with long-term lane shifts.
- Authority to make changes during construction: When removable tape is specified in the contract, the DTE must approve any request to substitute paint instead of tape. This applies to contracts already under construction if the long-term lane shift is being implemented after the issuance date of this IIM.
- Temporary marking material and width requirements: Sets forth material and width requirements (as applicable) for longitudinal, symbol/messages and traverse line temporary markings on non-final and final surfaces as well as for retracing, including special requirements for use of contrast tape on certain concrete roads/bridge decks. In particular, outlines when removable tape or other durable marking materials must be provided. Prohibits use of blackout tape on concrete roads/bridge decks.

1.0 PURPOSE AND NEED

This IIM provides requirements and guidance for the materials and widths to be used for temporary pavement markings in work zones.

[1] The Executive Summary provides a broad summary of the purpose and scope of the IIM, but users are governed by the requirements in the main body of this document.

This IIM is intended to be used by designers responsible for development and signing/sealing of Maintenance of Traffic Plans. It does not supersede the requirements of the Road & Bridge Specifications or the standard Paving Schedule Special Provisions.

This IIM applies to all construction and maintenance work zones within the VDOT ROW, including Design-Bid-Build, Design-Build, Public-Private Partnership (P3), locally-administered, Land Use Permit construction, and work by in-house forces.

Other aspects of temporary pavement markings, such as where to use them and what pattern (skip, dotted, etc.) to use, are outside the purview of this IIM. Those decisions are based on the Virginia Work Area Protection Manual (VWAPM), Manual on Uniform Traffic Control Devices (MUTCD), Virginia Supplement to the MUTCD, the Road & Bridge Specifications, the Road & Bridge Standard Drawings, and the engineering judgement of the engineer of record.

2.0 EFFECTIVE DATE

The effective dates for this IIM shall be as per **Table 1**.

Table 1 – IIM-TE-395 Applicability to VDOT Temporary Marking Activities

Contract Type	Applicability
Paving Schedules	2021 Schedules: IIM-TE-395 does not apply. 2022 and Subsequent Year Schedules: IIM-TE-395 applies.
Construction Contracts **(Design-bid-Build and D-B/P3)**	Contracts under construction as of IIM issuance date: • Section 5.0 of this IIM shall be effective for all MOT phases beginning after IIM issuance date. • IIM-TE-395 should be applied in its entirety to the extent feasible and practical, with contracts modified as necessary. Design-bid-build - Public Hearing plans finalized prior to IIM issuance date; Design-build & P3 - RFQ published prior to IIM issuance date: • Section 5.0 of this IIM shall be effective. • IIM-TE-395 should be applied in its entirety, to the extent feasible and practical. Design-bid-build - Public Hearing plans finalized after IIM issuance date; Design-build & P3 - RFQ published after IIM issuance date: • IIM-TE-395 applies.
Land Use Permits	Preliminary MOT plans submitted to VDOT prior to IIM issuance date: • Section 5.0 of this IIM shall be effective for all MOT phases beginning after IIM issuance date. • IIM-TE-395 should be applied in its entirety, to the extent feasible and practical. Preliminary MOT plans submitted to VDOT on or after IIM issuance date: • IIM-TE-395 applies.

3.0 BACKGROUND

Table 2 summarizes VDOT's primary temporary marking material options, which are based on the following factors:

- Safety – Retroreflectivity and width both play a critical role in ensuring the markings provide effective delineation at night. This is true for both temporary and permanent markings, however work zones can be a particularly challenging environment for drivers due to conditions such as narrowed lanes, shifted lanes, "cattle chute" conditions, "ghost lines" left by eradication or blacking out of previous lines, visual distraction due to adjacent construction activities, a multitude of work zone signs and other temporary traffic control devices, etc.

  Figure 1 illustrates visual appearance at night for lines illuminated by headlights under nighttime dry conditions at different retroreflectivity levels (as measured in mcd/m2/lx). Generally, white lines at or above 150 mcd/m2/lux provide very good guidance to drivers, while white lines below 50 mcd/m2/lux provide minimal benefit to drivers at night[2].

  Width also plays a critical role in line visibility. A 6" line with poorer retroreflectivity may have equal visibility as a 4" line with better retroreflectivity.

  Visibility is even more important during wet night conditions. Wet retroreflectivity is different from dry retroreflectivity and is not easy to accurately measure with repeatable results, however generally lines with higher dry retroreflectivity also have higher wet retroreflectivity ("wet continuous" or "wet recovery" conditions).

  For vehicles relying on machine vision (i.e. Lane Keep Assist or Automated Departure Warning Systems), the key factors are width and contrast. On higher-speed roads, it is critical to have some contrast between the line and the surface on lighter-colored surfaces, such as bridge decks and Portland Cement Concrete pavements.

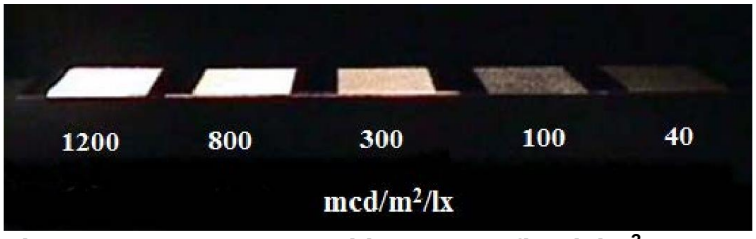

Figure 1 – pavement marking retroreflectivity[3].

- Durability – Marking material makes a considerable difference in durability – the duration of time that the line provides sufficient presence and retroreflectivity for nighttime drivers. Durability also relates to safety, as there is an increased risk of a work zone crash every time VDOT personnel or contractors must close additional lanes to refresh temporary markings within their work zone.

[2] Thresholds for white lines. Many agencies set slightly lower thresholds for yellow lines.

[3] Source: *Deterioration of Pavement Marking Retroreflectivity in the Province of New Brunswick*, MacEacheron, 2014.

- Construction phasing – For lines on non-final surfaces, it is critical to understand what work will be going on in the next phase of construction (i.e. resurfacing or full-depth reconstruction). On final surfaces, a critical consideration is minimizing use of materials that will require eradication, resulting in scarring of the final surface.

- Cost – It is important to consider the holistic life-cycle costs, taking into account the cost of both initial installation and future retrace operations for the duration of the construction phase. For construction phases that last multiple months on higher-volume roads, it is generally more cost-effective and safer to spend more up-front for a more durable material so as to limit the number of future retrace operations required of the contractor.

Table 2: Temporary Marking Material Options for Longitudinal Lines

Material	Description	Advantages[4]	Disadvantages
Conventional Paint (Type A)	15 mils traffic paint with Type 1 beads[5].	• Least expensive • Can be quickly applied • Does not require eradication before overlay operations • Can typically be applied using a mobile lane closure • Can be refreshed if needed	• Provides minimal retroreflectivity – will typically quickly degrade well below 100 mcd within months on higher-volume roads or after the first snowplow event
High Build Paint[6]	25~27 mils "high build" paint formulation with Type 3 beads	• Significantly more durable than conventional paint; will retain acceptable retro for much longer periods • Does not require eradication before overlay operations • Can typically be applied using a mobile lane closure • Can be refreshed with conventional or high-build paint if needed	• More expensive than Type A conventional paint, though less expensive than removable tape • Slower application and longer drying time than conventional paint •
Wet Reflective Removable Tape (Type D, Class III or "D-3")[7]	Removable tape with wet reflective properties	• Can usually be easily peeled up with no damage to underlying pavement • Should retain acceptable retroreflectivity for 6+ months • Only product designed to provide retro even under wet continuous/wet recovery conditions	• Most expensive option • Requires second MOT operation for removal • Can be refreshed with paint but not with tape • Cannot be installed below 50 ºF • Requires eradication before overlay operations

[4] All descriptions of durability are predicated on the assumption that ambient temperature, surface moisture, application technique, etc. is as per the Specifications and manufacturer's recommendations.

[5] On resurfacing contracts where the temporary line is placed on the final surface 30~45 days prior to permanent line placement, VDOT specifications require a "thin line" application (thinner application, sparser glass bead dispersion, 75% width of the permanent line), and skips at 75% length to ensure the permanent line adequately bonds to the pavement.

[6] As of the issuance date of this IIM, this is a pilot marking material not yet incorporated into the Road & Bridge Specifications. Many other state DOTs commonly use high-build paint for permanent markings.

[7] VDOT no longer uses Type D, Class II removable tape.

4.0 TEMPORARY MARKING POLICY

4.1 *Temporary Center, Edge, and Lane Line Markings*

All temporary center, edge, and skip/dotted lane line markings shall use the widths and materials shown in **Tables 3 and 4** for non-final and final surfaces respectively. If the VWAPM requires a greater width than Tables 3 or 4 for a particular location, then width shall be as per the VWAPM.

Table 3: Temporary Center, Edge, and Lane Line Policy (Non-Final Surface)

Anticipated Duration	non-paving schedule			paving schedule
	≤ 35 mph WZ or posted speed limit (1) (2)	non-limited access ≥ 40 mph WZ or posted speed limit (5)	Limited-access highway, including associated ramps (5)	
< 1 month	Material: conventional paint Width: 4”	Material: D-3 Tape Width: 4”	Material: D-3 Tape Width: same as corresponding permanent line	4” Conventional Paint
1-6 months	Material: Conventional paint Width: 4”	Material: D-3 Tape Width: same as corresponding permanent line		n/a
> 6 months (3)	Material: Conventional or high-build paint (4) Width: 4”	Material: D-3 Tape or High-Build Paint Width: same as corresponding permanent line		

Table 3 Notes:

(1) The “≤ 35 mph speed” column should be used for all one-lane two-way operations with temporary/portable traffic control signals (similar to VWAPM Figure TTC-25), unless speeds exceeding 35 mph are expected based on engineering judgment.

(2) For longer work zones with a short isolated section that has a reduced advisory speed limit, it is acceptable to continue the same material and width through the isolated section.

(3) This category duration also applies to any temporary markings expected to be in place for the duration of winter.

(4) For work exceeding 6 months duration, engineering judgment should be used in deciding whether to specify standard or high-build paint, depending on factors including ADT, truck volumes, and anticipated snowplow activity.

(5) On non-final surfaces, 4” conventional paint shall be specified for edge lines that are within one foot of the toe of temporary barrier service, as long as the barrier will be present for the duration of construction. If conventional paint is used for an edge line parallel to temporary barrier service, the conventional paint line also extends across isolated barrier interruptions for construction entrances or emergency pull-offs.

Table 4: Temporary Center, Edge, and Lane Line Policy (Final Surface)

Anticipated Duration	Temp line in same location as final marking (1) (2)	Temp line in different location as permanent line
< 1 month	Material: Conventional paint Width: See Note (3)	Material: D-3 Tape Width: 4″
1-6 months	n/a - the Specifications do not ever allow the Contractor to defer permanent marking installation by more than 1 month when traffic is in its final location	Material: D-3 Tape Width: same as corresponding permanent line
> 6 months		

Table 4 Notes:

(1) For projects on new alignment, all permanent markings must be in place before the new alignment is opened to traffic.

(2) If the permanent marking is Type B Class VI marking (patterned preformed tape a.k.a. "B6 tape") and the final surface is an asphalt surface, then Contractors are required to inlay the tape in asphalt mat during the paving operation, or provide temporary markings at his expense should he fail to achieve successful tape inlaying for any reason. Therefore designers should not provide temporary marking quantities in such situations.

(3) Where conventional paint is placed on the final surface as an interim marking until the permanent line can be applied, the Road & Bridge Specifications require the interim marking to be reduced width, thinner (approx. 8 mils) thickness, and fewer glass beads per gallon. In such cases, the interim marking paint width pay item should be specified as per **Table 5**.

Table 5: Interim Line Marking Widths in Same Location as Permanent Lines

Permanent Line Width	Interim Paint Width Pay Item
4″	4″
6″	4″
8″	6″
12″	8″
24″	See Section 4.5

4.2 *Material Requirements When Retracing Temporary Markings*

For situations where the Contractor must retrace the temporary markings due to marking failure (lack of presence, deficient retroreflectivity, or other modes of failure), the temporary markings should be retraced using the materials indicated in **Table 6**:

Table 6: Temporary Pavement Marking Retracing

Material Used for Initial Temp. Marking Application	Material Used for Retracing of Temp. Marking
Conventional Paint	Conventional Paint
High Build Paint	High Build or Conventional Paint – see Table 3, with duration calculated as beginning from date of retrace
Temporary Tape	Temporary Tape shall be used for retracing, except conventional paint may be used during winter when temperatures are too low to support tape application. If the markings will still be in place next spring, then temporary tape should be applied as soon as weather permits.

The Specifications address when this retracing is at VDOT expense vs. when the Contractor is required to retrace at his own expense (e.g. due to improper installation).

4.3 *Contrast Markings on Concrete*

In situations where there is little visual contrast between the markings (particularly white markings) and light-colored pavement, this could result in confusion for drivers relying on either human vision or machine vision (i.e. Lane Keep Assist systems).

Therefore, if Type D-III removable tape is used, then the removable tape with contrast (black-bordered) properties shall be specified for all longitudinal white lines on all concrete road or bridge deck segments that have all of the following properties:

- Duration of 1 month or longer,
- Concrete segment/bridge deck is ≥ 200 ft long, and
- Speed limit is ≥ 45 mph

Removable yellow tape may also be provided with contrast (black-bordered) properties based on engineering judgment.

4.4 *Type E Blackout Tape and Eradication on Bridge Decks*

Type E tape (blackout tape) shall not be used on concrete surfaces, to minimize risk of confusion to drivers relying on either human or machine vision.

Any proposed eradication activities on bridge decks should be coordinated with District Structure & Bridge.

Conflicting pavement markings on bridge decks may be left in place, without need for eradication, if (a) the existing bridge deck is not slated for replacement as a part of the project, and (b) the bridge deck is 200 feet or shorter in length.

4.5 *Other Temporary Markings*

Temporary markings not governed by Section 3.1 shall be as per **Table 7**.

Table 7: Other Temporary Markings

Marking Type	Nonfinal Surface	Final Surface (line in different location than permanent marking)
Gore lines and accel/decel lane lines	Material shall be as per Table 3. Width shall be as per VWAPM.	Material shall be removable tape. Width shall be as per the VWAPM.
Stop lines	Conventional paint should typically be used for construction phases 6 months or less. Removable tape markings should be used for construction phases > 6 months. Temporary stop lines may be 12" on resurfacing contracts, and on other contracts where they are expected to be in place for < 1 month. All other temporary stop lines shall be 24".	Material shall be removable tape. Width shall be 12" or 24".
All other lines (crosswalks, turn lanes, etc.)	Conventional paint should typically be used for construction phases 6 months or less. Removable tape markings should be used for construction phases > 6 months. . 6" or greater width shall be specified for crosswalk lines; all other lines should be 4" width unless required otherwise by the VWAPM.	Material shall be removable tape. 6" or greater width shall be specified for crosswalk lines; all other lines should be 4" width unless required otherwise by the VWAPM.
Symbols/messages	Conventional paint should typically be used for construction phases 6 months or less. Removable tape markings should be used for construction phases > 6 months.	Temporary symbol/message markings should be avoided where possible. If unavoidable, removable materials shall be used.

4.6 *Temporary Raised Pavement Markers*

TRPMs usage shall be as per the VWAPM.

5.0 CHANGES DURING ADVERTISEMENT OR CONSTRUCTION

For contracts calling for Type D-3 markings for a certain stage of construction, the material shall not be changed to a different material without approval of the District Traffic Engineer or designee.

Under certain circumstances, Contractors may substitute Flexible Temporary Pavement Markers (FTPMs) for temporary conventional paint. These circumstances are addressed by the Road & Bridge Specifications. There is no separate pay item for FTPMs; these lines are paid for as temporary pavement markings, and a Contractor's substitution with FTPMs is at no additional cost to the Department.

6.0 REFERENCES

- Virginia Work Area Protection Manual
- Road & Bridge Specifications
- Paving Schedule Special Provisions
- Road & Bridge Standards